object height is 10 cm

focal length is 15 cm

find M, d_i, h_i

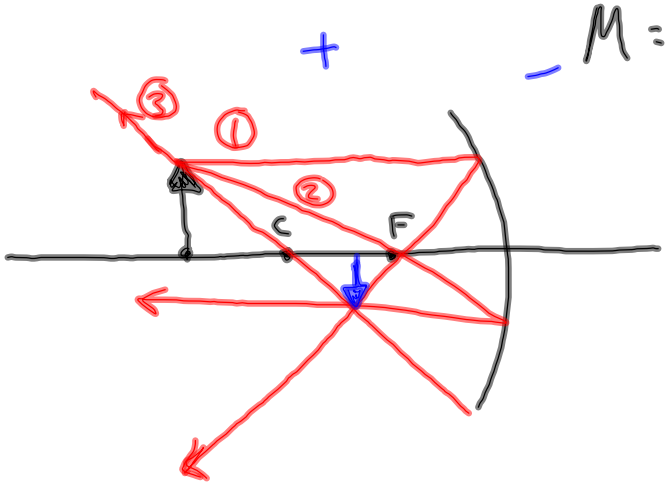
image characteristics

Concave mirror

object distance is 45 cm

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$M = -\frac{d_i}{d_o} = \frac{h_i}{h_o}$$



inverted
real
smaller

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$d_i = \left[\frac{1}{f} - \frac{1}{d_o}\right]^{-1}$$

$$= 22.5 \text{ cm}$$

$$M = -\frac{d_i}{d_o}$$

$$= -\frac{22.5 \text{ cm}}{45.0 \text{ cm}}$$

$$= -0.5$$

$$M = \frac{h_i}{h_o}$$

$$h_i = M h_o$$

$$= (.5)(10 \text{ cm})$$

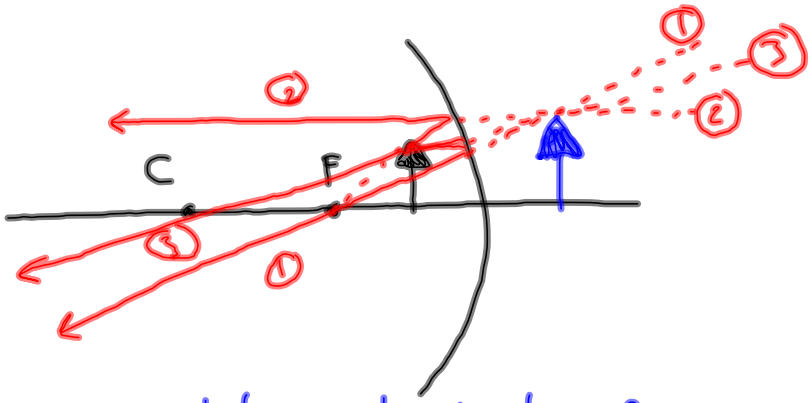
$$= -5 \text{ cm}$$

Concave mirror

$h_o = 10\text{ cm}$ $f = 15\text{ cm}$

$d_o = 5\text{ cm}$

Find M, d_i, h_i, characteristics



upright, virtual, larger

$$d_i = \left[\frac{1}{f} - \frac{1}{d_o}\right]^{-1}$$

$$= -7.5\text{ cm}$$

$$M = -\frac{d_i}{d_o}$$

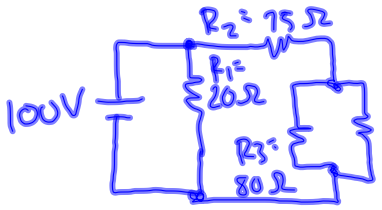
$$= -\frac{(-7.5\text{cm})}{5\text{cm}}$$

$$= 1.5$$

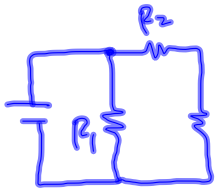
$$h_i = M h_o$$

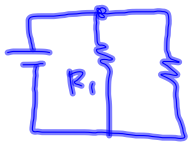
$$= (1.5)(10\text{cm})$$

$$= 15\text{ cm}$$



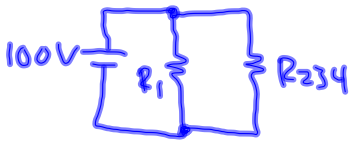
find all V's and I's





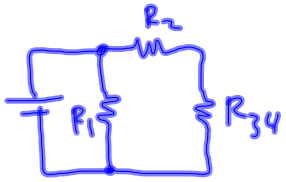
$$V_{battery} = I_{total} R_{eq}$$

$$I_{total} = \frac{100\,V}{16.8\,\Omega} = 5.95\,A$$



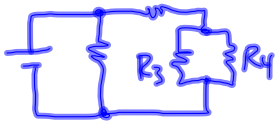
$$I_1 = \frac{V_{batt}}{R_1} = \frac{100\,V}{20\,\Omega} = 5\,A$$

$$I_{234} = \frac{V_{batt}}{R_{234}} = \frac{100\,V}{105.8\,\Omega} = .95\,A$$



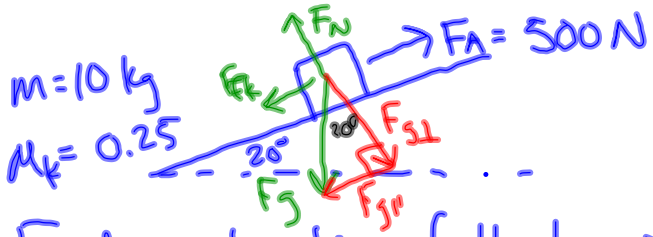
$$V_2 = I_{234} R_2 = (.95\,A)(75\,\Omega) = 71.2\,V$$

$$V_{34} = I_{234} R_{34} = (.95\,A)(30.8\,\Omega) = 28.8\,V$$

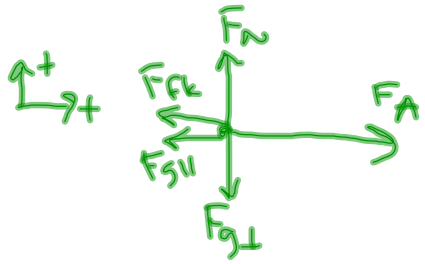


$$I_3 = \frac{V_{34}}{R_3} = \frac{28.8\,V}{80\,\Omega} = .36\,A$$

$$I_4 = \frac{V_{34}}{R_4} = \frac{28.8\,V}{50\,\Omega} = .58\,A$$



Find acceleration of the box up the ramp.



$$\Sigma F_{\parallel} = ma_{\parallel}$$

$$a_{\parallel} = \frac{\Sigma F_{\parallel}}{m}$$

$$= \frac{F_A - F_{fk} - F_{g\parallel}}{m}$$

$F_{fk} = \mu_k F_N$

$= (.25)(92.8\,N)$

$= 23\,N$

$\Sigma F_{\perp} = \emptyset$

$F_N - F_{g\perp} = \emptyset$

$F_N = F_{g\perp}$

$= F_g \cos(20°)$

$= mg \cos(20°)$

$= (10\,kg)(9.8\,m/s^2)\cos(20°)$

$= 92.1\,N$

$F_{g\parallel} = F_g \sin($

$= mg \sin($

$= (10\,kg)(9.8\,m/$

$\sin($

$= 33.5\,N$

$= \frac{1}{(10\,kg)}\left[500\,N - 23\,N - 33.5\,N\right]$

$= 44.4\,m/s$